

APPENDIX I

PRELIMINARY RISK ASSESSMENT

Memorandum

Date: 8/18/2003

To: Preliminary Risk Assessment (PRA) File

From: Paul F. Goetchius, DVM
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RE: Ranges West of Iron Mountain Road, Main Post, Parcels 73Q-X, 91Q-X, 115Q, 116Q-X, 117Q-X, 129Q-X, 151Q, 181(7), 194(7)/518(7), 200Q, 201Q, 228Q, 229Q-X, 231Q, 232Q-X, Washington Tank Range, and 1950 Rocket Launcher Range; Fort McClellan

PRELIMINARY RISK ASSESSMENT FOR SUBJECT SITE: REVISION 3

This memorandum provides a Preliminary Risk Assessment (PRA) for exposure to surface soil, subsurface soil, groundwater, surface water and sediment at the Ranges West of Iron Mountain Road, hereinafter referred to as the RWIMR. The PRA approach is a shortened version of the Streamlined Risk Assessment (SRA) protocol developed as a uniform and economical approach to evaluating hundreds of similar sites at Fort McClellan (FTMC). It is assumed that the reader is familiar with FTMC and the fundamentals of the SRA protocol. The reader is referred to the Installation-Wide Work Plan (IWWP) (IT, 2002) for more detail. The comparison and computational operations of the PRA were performed within EXCEL® spread sheet tables.

The first version of the PRA for the RWIMR, including Parcels 114Q-X and 221Q-X, was prepared in November 2001. That effort identified lead in surface soil, antimony in groundwater, and 4-amino-2,6-dinitrotoluene (ADNT) in groundwater as “risk drivers,” i.e., chemicals that caused the quantitative risk estimates to exceed acceptable limits. High levels of lead in surface soil were associated with Parcels 114Q-X and 221Q-X.

Several actions were taken following the November 2001 PRA. Parcel 114Q-X was removed from the RWIMR evaluation and elevated to the status of a Remedial Investigation, in order to more adequately characterize both the nature and extent of contamination as well as the risk. Parcel 221Q-X was removed from the RWIMR evaluation for inclusion in the Iron Mountain Road Engineering Evaluation/Cost Analysis to address remediation of lead. Antimony and ADNT in groundwater, two of the risk drivers in the November 2001 PRA, had been identified in five wells scattered among Parcels 91Q-X, 117Q-X, 228Q and 232Q-X. These wells were subsequently re-sampled twice – the first time in June and the second time in September, November or December 2002- and analyzed for antimony or ADNT, whichever had been detected in the earlier samples. All samples taken in 2002 were nondetect for antimony and ADNT, suggesting that the scattered detections in 2001 had been spurious findings.

The PRA was revised in March of 2003 for the purpose of supporting a no-further-action decision for the RWIMR, including the parcels listed in the "Subject" line of this memo, based on the revised data set, but not including Parcels 114Q-X and 221Q-X. The revised data set included all the data evaluated in the November 2001 PRA *excluding* soil data from Parcels 114Q-X and 221Q-X, *excluding* groundwater data from the wells that were re-sampled in 2002, and *including* the supplemental groundwater data from the 2002 re-sampling.

The March 2003 PRA determined that practically all the metals in surface and subsurface soil, groundwater and sediment were site-related; i.e., their concentrations appeared to exceed background concentrations. Subsequent to that exercise, however, the protocol for FTMC for comparing background and site data sets and for selecting site-related chemicals has changed, making better use of both background and site data, applying more precise statistical comparisons, and employing geochemical analysis to help resolve the site-related question for difficult cases. The refinement in the procedure for selecting site-related chemicals was the main reason for this (third) revision of the PRA. Also, instead of evaluating exposure to subsurface soil as a separate medium, subsurface and surface soil data were combined to form a data set called "total soil," to cover for the likelihood that development for any use would involve excavation and grading that could bring subsurface soil to the surface, and because a receptor could not be exposed to subsurface soil without being exposed to surface soil.

Media of Interest and Data Selection. Data consist of:

- One hundred and one surface soil samples (including 3 depositional soil samples) analyzed for metals; and 6 of the 101 samples also analyzed for semivolatile organic compounds (SVOC) and volatile organic compounds (VOC).
- Ninety-four subsurface soil samples analyzed for metals, and 6 of the 94 samples also analyzed for VOCs.
- Fifty-seven groundwater samples analyzed for metals, nitroaromatic and nitramine explosives, perchlorate and VOCs.
- Eighteen surface water samples analyzed for metals and perchlorate.
- Eighteen sediment samples analyzed for metals only.

The validated data are summarized in Tables 5-1 through 5-5 from the Site Investigation (SI).

Field duplicates, "R" qualified data (rejected because of quality issues), "U" qualified data (nondetect) and "B" qualified data (blank contamination) were not included in the evaluation. Visual appraisal of the excluded data revealed that none of the excluded "B" qualified data exceeded their site-specific screening levels (SSSL) *and* background screening criterion (BSC) (see Site-Related Chemical Selection below for explanation of BSC) except as follows:

- Several “B” qualified detections of nutritionally required trace elements that are not generally included in a risk assessment were not evaluated further.
- The concentration of antimony (6.92 mg/kg) in one surface soil sample exceeded the residential soil SSSL (3.11 mg/kg) and the BSC (1.99 mg/kg). The associated hazard index (HI), however, is 0.2, which is well below the threshold level of 1. It is concluded that excluding the “B” qualified antimony detection in surface soil had no effect on the outcome of the PRA.
- The concentration of antimony (4.67 and 5.33 mg/kg) in two subsurface soil samples exceeded the residential soil SSSL and the BSC (1.31 mg/kg). The associated HI for the higher hit, however, is 0.2, which is well below the threshold level of 1. It is concluded that excluding the “B” qualified antimony detection in the two subsurface soil samples had no effect on the outcome of the PRA.
- The concentration of cadmium in one groundwater sample ($7.71\text{E-}3$ mg/L) exceeded its SSSL ($7.82\text{E-}4$ mg/L) and its BSC ($2.51\text{E-}3$ mg/L). The associated HI is 1. Excluding this cadmium detection represents a small source of uncertainty in the PRA.
- The concentration of thallium in one groundwater sample ($5.65\text{E-}3$ mg/l) exceeded its SSSL ($1.02\text{E-}4$ mg/L) and its BSC ($1.45\text{E-}3$ mg/L). The associated HI is 5.5. Excluding this thallium detection represents a small source of uncertainty in the PRA.

Site-Related Chemical Selection. Site-related chemicals are those presumed to be released by the army during operation of FTMC. Site-related metals were selected by a three-tier process as described in a technical memorandum (Shaw E&I, 2003) on background screening. Briefly, The procedure consists of: (Tier 1) comparing the maximum detected concentration (MDC) of each chemical with its BSC, computed as two times the mean of the background data set, consistent with EPA (2002a) Region IV guidance; (Tier 2) one or more statistical tests, depending on the characteristics of the background and site data sets; and (Tier 3), geochemical evaluation. All organic chemicals were selected as site-related because most of them are not naturally occurring and were presumed to be present as a result of site activities. The results of the site selection process are presented in Tables 1 through 5 for surface soil, total soil, groundwater, surface water and sediment, respectively.

Site-related chemicals identified in surface soil include cadmium and all the organic chemicals identified in surface soil (Table 1). Of particular interest is the observation that lead was not selected as a site-related metal. This is counter-intuitive for areas that have been used as shooting ranges. However, as discussed above, the parcels with higher lead levels (Parcels 114Q-X and 221Q-X) were moved to other reports for more detailed evaluation. Removing these parcels left a low frequency of elevated concentrations in the remaining site samples, which resulted in the background comparison passing the Tier 2 tests. Based on knowledge about the former use of the RWIMR, however, lead is treated as a site-related chemical as discussed below.

Metals other than lead associated with bullets whose highest concentrations may have been reduced by removal of the parcels noted above include antimony, arsenic, copper, nickel and zinc (EPA, 2002b). Antimony, however, was identified in only 6 of 100 samples at “J” qualified (estimated) concentrations (data not shown). Furthermore, only one of the detections occurred in the same sample in which the concentration of lead exceeded its BSC (data not shown). Therefore, it is concluded that antimony in surface soil is randomly distributed, is present at concentrations comparable to background and does not reflect a site-related release.

Only two detections of arsenic in surface soil exceeded its BSC. Neither of these detections, however, occurred in samples in which lead occurred at concentrations above its BSC. Therefore, it is concluded that arsenic in surface soil is randomly distributed, is present at concentrations comparable to background and does not reflect a site-related release.

MDCs of copper, nickel and zinc in surface soil all fall below their respective SSSLs. Therefore, it is concluded that their presence would have no significant effect on the outcome of the PRA, and these metals in surface soil are considered no further.

Site-related chemicals identified in total soil include cadmium, selenium, and all the organic chemicals identified in soil (Table 2). The discussion in the previous paragraph regarding lead in surface soil pertains to total soil as well. Similarly, there is the same concern for antimony and arsenic in total soil. However, all 22 antimony concentrations in total soil were “J” qualified (data not shown), and only two of the detections occurred in the same sample in which the concentration of lead exceeded its BSC (data not shown). Therefore, it is concluded that antimony in total soil is randomly distributed, is present at concentrations comparable to background and does not reflect a site-related release. This conclusion is further substantiated by the results of the geochemical analysis.

Five arsenic detections in total soil exceeded their BSC (data not shown). However, none of these arsenic detections occurred in samples in which the concentration of lead exceeded its BSC (data not shown). Therefore, it is concluded that arsenic in total soil is randomly distributed, is present at concentrations comparable to background and does not reflect a site-related release. This conclusion is further substantiated by the results of the geochemical analysis.

MDCs of copper, nickel and zinc in total soil all fall below their respective SSSLs. Therefore, it is concluded that their presence would have no significant effect on the outcome of the PRA and they are considered no further.

Site-related chemicals identified in groundwater include beryllium, perchlorate, and a fairly long list of organic chemicals consisting of several nitroaromatic compounds and several VOCs (Table 3). Notably, lead was not selected as a site-related chemical at the Tier 2 level. The MDC for lead, however, was below the SSSL. Therefore, lead in groundwater is considered no further.

Site-related chemicals identified in surface water are limited to perchlorate (Table 4). Notably, lead was not selected as a site-related chemical at the Tier 2 level. The MDC, however, only slightly exceeded the BSC (IT, 2000), reducing concern that Tier 2 statistical testing may have

been unable to identify lead as a site-related chemical. Furthermore, most forms of lead associated with ammunition and its degradation products are only slightly soluble, reducing concern that erosion or runoff from surface soil would result in elevated levels of soluble lead in water. Lead in surface water is considered no further.

No chemicals in sediment were determined to be site-related (Table 5). All lead concentrations fell within the background range (IT, 2000) and well below the SSSL. Lead in sediment is considered no further.

Receptor Scenario Selection. The RWIMR consist of an approximately 750-acre area. Some of the area will be incorporated into the Anniston Eastern Bypass, a highway being constructed around the city of Anniston. Potential future uses for the remainder include:

- Passive recreation.
- “Cultural,” e.g., developed for nature walks and other educational purposes, and open to the public.
- Development as an office complex.
- Development for retail purposes.
- Designated as a “developmental reserve,” the meaning of which is not clear.

Surrounding land uses include various industrial/commercial applications, passive recreation, and residential use within approximately one-half mile. The residential exposure scenario was chosen for the PRA as the upper-bound on long-term exposure and risk. A site that is suitable for residential use can be released for unrestricted use requiring no further action. SSSLs for residential exposure were used to select COPCs for surface soil, subsurface soil and groundwater, assuming that groundwater may be developed for potable use.

Chemical of Potential Concern Selection. Chemicals of potential concern (COPC) are site-related chemicals whose MDCs exceed their SSSLs, and which may contribute significantly to risk. The SSSLs are receptor-, medium-, and chemical-specific risk-based concentrations that capture all the exposure assumptions and toxicity assessment of a complete baseline risk assessment. COPCs are selected for both cancer risk and noncancer effects when the data permit.

Tables 1 and 2 indicate that no chemicals were selected as COPCs in surface or total soil. However, as discussed above, lead is selected as a site-related chemical for both surface and subsurface soil. Since the MDC for lead exceeds the SSSL, it is selected as a COPC for both media. COPCs in groundwater include beryllium, 2,6-dinitrotoluene, perchlorate and acetone (Table 3). No chemicals were selected as COPCs in surface water (Table 4) or sediment (Table 5).

Risk Characterization. Risk characterization combines the exposure assumptions and toxicity assessment (incorporated in the SSSLs) with the exposure-point concentration (EPC) to quantify the incremental lifetime cancer risk (ILCR) and noncancer hazard index (HI). ILCR and HI estimates are computed for each COPC in each medium, and are summed across COPCs and media to yield a total ILCR and total HI for each receptor scenario. The PRA differs from an SRA in that ordinarily no attempt is made to estimate an EPC that reflects a conservative estimate of average concentration for use in risk assessment. Instead, the MDC is adopted as the EPC, which imparts a conservative bias to the assessment.

EPA (1990) considers ILCR estimates below $1\text{E-}6$ to be negligible, ILCR estimates from $1\text{E-}6$ to $1\text{E-}4$ to fall within a risk management range, and ILCR estimates above $1\text{E-}4$ to be generally unacceptable. EPA (1989) considers HI values that do not exceed the threshold level of 1 to indicate that the occurrence of adverse noncancer health effects is unlikely.

Summing HI values across chemicals, however, is considered to impart a conservative bias to the assessment, because only those chemicals that share a mechanism of toxicity are likely to interact in an additive manner. Since data regarding mechanism of toxicity are generally insufficient, target organ or critical effect is often used as a surrogate. In other words, chemicals that act upon the same target organ or that have the same critical effect are considered to act by the same mechanism of toxicity. Therefore, when HI values summed across chemicals and media exceed the threshold level of 1, the HI values may be re-summed by target organ to refine the assessment.

Risk estimates may be rounded to one significant figure to reflect the uncertainty about their computation (EPA, 1989, 2002a). For example, a calculated ILCR of $9.50\text{E-}7$ would be rounded to $1\text{E-}6$ and interpreted as falling within the risk management range. Similarly, a calculated ILCR of $1.49\text{E-}4$ would be rounded to $1\text{E-}4$ and interpreted as falling within, but not exceeding, the risk management range. Also, an HI of $1.49\text{E+}0$ would be rounded to 1 and interpreted as not exceeding the threshold level of 1. Risk and hazard estimates in this document are presented in scientific notation with two places to the right of the decimal to facilitate checking calculations. Rounding is done only if needed to simplify interpretation.

The foregoing discussion applies to all chemicals other than lead. The risk characterization of lead is discussed below.

COPCs other than lead were identified only in groundwater (Table 5-3). Therefore, ILCR and HI values are estimated only for groundwater, and the risk values for groundwater reflect the totals summed across all media. 2,6-Dinitrotoluene was identified as the only potentially carcinogenic COPC in groundwater. The ILCR for 2,6-dinitrotoluene of $1.73\text{E-}6$ falls at the low end of the EPA (1990) risk management range. Beryllium, perchlorate and acetone were identified as COPCs associated with noncancer effects. The total HI of $8.69\text{E-}1$ does not exceed the threshold level of 1, indicating that the likelihood of adverse effects is low. None of the MDCs of the site-related chemicals exceeded their maximum contaminant levels (MCL) (EPA, 2002c).

Lead was selected as the only COPC in surface soil and total soil. The higher concentrations occurred in surface soil, but only the MDC of $3.18\text{E}+3$ mg/kg exceeded the SSSL of 400 mg/kg. The SSSL, however is based on the Integrated Exposure Uptake Biokinetic Model for blood lead levels in children (EPA, 2003a), which is designed to use the arithmetic mean concentration of lead rather than the MDC as the EPC. The arithmetic mean concentrations of lead in surface soil and total soil are $5.04\text{E}+1$ and $3.19\text{E}+1$ mg/kg, respectively (data not shown), which fall far below the SSSL of 400 mg/kg. Also, the MDC of $3.18\text{E}+3$ mg/kg falls below the recent EPA (2003b) Region IV acute criterion for lead in soil of $6.5\text{E}+3$ mg/kg intended to be protective for a 2-year-old child exposed by pica.

Summary and Conclusions. In summary, parcels in the subject line of this memo that comprise the RWIMR were evaluated for residential exposure to surface soil, total soil, groundwater, surface water and sediment. Lead was identified as the only COPC in soil. Beryllium and several organic chemicals were identified as site-related compounds in groundwater. The concentrations of chemicals in groundwater, however, were generally low, so that few chemicals were selected as COPCs. ILCR and HI estimates fell within acceptable limits, and none of the site-related chemical concentrations exceeded their MCLs.

Lead was identified as a COPC only in soil. Although the MDC exceeded the SSSL, the arithmetic mean lead concentration did not, indicating that it is unlikely that long-term exposure to lead in soil at the RWIMR would induce adverse health effects in children, the most sensitive members of the human population. Furthermore, the MDC fell below the acute exposure criterion of $6.5\text{E}+3$ mg/kg, indicating that adverse effects from acute exposure also are unlikely. It is concluded that the parcels listed above within the RWIMR can be released for unrestricted use with no further action.

References

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U.S. Environmental Protection Agency (EPA), 2002c, *2002 Edition of the Drinking Water Standards and Health Advisories*, Office of Water, Washington, DC, EPA 822-R-02-038, Summer.

U.S. Environmental Protection Agency, 2003a, *Integrated Exposure Uptake Biokinetic Model for Lead in Children, Windows® Version (IEUBKwin v1.0 build 253)* on line, March.

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Table 1

**Preliminary Risk Assessment for Exposure to Surface and Depositional Soil
Ranges West of Iron Mountain Road
Fort McClellan, Calhoun County, Alabama**

| Chemical | MDC | Site-Related Chemical? ^a | Residential Soil SSSL-c ^b | Residential Soil SSSL-n ^c | Residential Cancer COPC? ^d | Residential Noncancer COPC? ^e | Residential ILCR ^f | Residential HI ^g |
|------------------------------|----------|-------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|--|-------------------------------|-----------------------------|
| Metals | | | | | | | | |
| Aluminum | 2.66E+04 | No(3) | NA | 7.80E+03 | | | | |
| Antimony | 5.57E+00 | No(2) | NA | 3.11E+00 | | | | |
| Arsenic | 2.91E+01 | No(2) | 4.26E-01 | 2.34E+00 | | | | |
| Barium | 2.63E+02 | No(2) | NA | 5.47E+02 | | | | |
| Beryllium | 2.04E+00 | No(3) | NA | 9.60E+00 | | | | |
| Cadmium | 4.37E+00 | 4.37E+00 | NA | 6.25E+00 | | | | |
| Calcium | 9.12E+03 | No(E) | NA | NA | | | | |
| Chromium ^h | 5.58E+01 | No(2) | NA | 2.32E+01 | | | | |
| Cobalt | 3.60E+01 | No(2) | NA | 4.68E+02 | | | | |
| Copper | 6.14E+01 | No(2) | NA | 3.13E+02 | | | | |
| Iron | 7.01E+04 | No(2) | NA | 2.34E+03 | | | | |
| Lead | 3.18E+03 | No(2) | NA | 4.00E+02 | | | | |
| Magnesium | 5.29E+03 | No(E) | NA | NA | | | | |
| Manganese | 4.11E+03 | No(2) | NA | 3.63E+02 | | | | |
| Mercury | 1.67E-01 | No(3) | NA | 2.33E+00 | | | | |
| Nickel | 3.97E+01 | No(2) | NA | 1.54E+02 | | | | |
| Potassium | 2.07E+03 | No(E) | NA | NA | | | | |
| Selenium | 6.52E-01 | No(3) | NA | 3.91E+01 | | | | |
| Sodium | 5.21E+01 | No(E) | NA | NA | | | | |
| Thallium | 3.48E+00 | No(3) | NA | 5.08E-01 | | | | |
| Vanadium | 4.43E+01 | No(1) | NA | 5.31E+01 | | | | |
| Zinc | 1.08E+02 | No(3) | NA | 2.34E+03 | | | | |
| Semivolatile Organics | | | | | | | | |
| 2,4-Dinitrotoluene | 2.20E-01 | 2.20E-01 | 9.27E-01 | 1.55E+01 | | | | |
| Pentachlorophenol | 2.50E-01 | 2.50E-01 | 5.25E+00 | 2.33E+02 | | | | |
| Pyrene | 3.70E-01 | 3.70E-01 | NA | 2.33E+02 | | | | |
| Volatile Organics | | | | | | | | |
| 2-Butanone | 1.20E-02 | 1.20E-02 | NA | 4.66E+03 | | | | |
| Acetone | 3.90E-01 | 3.90E-01 | NA | 7.76E+02 | | | | |
| Methylene chloride | 1.20E-03 | 1.20E-03 | 8.41E+01 | 4.66E+02 | | | | |
| p-Cymene | 2.20E-03 | 2.20E-03 | NA | 1.55E+03 | | | | |
| Total ILCR, HI | | | | | | | -- | -- |

Table 1

**Preliminary Risk Assessment for Exposure to Surface and Depositional Soil
Ranges West of Iron Mountain Road
Fort McClellan, Calhoun County, Alabama**

All concentrations expressed as mg/kg.

MDC = Maximum Detected Concentration; COPC = Chemical of Potential Concern; ILCR = Incremental Lifetime Cancer Risk; HI = Hazard Index.

-- = Not Calculated

NA = Not Available

^a MDC presented only for site-related chemicals.

No(E) = Deselected as a site-related chemical as a nutritionally required element.

No(1) = Deselected as a site-related chemical at Tier 1.

No(2) = Deselected as a site-related chemical at Tier 2.

No(3) = Deselected as a site-related chemical at Tier 3.

^b Site-specific screening level based on cancer risk for residential exposure to soil.

^c Site-specific screening level based on noncancer hazard for residential exposure to soil.

^d MDC presented only if it exceeds SSSL-c.

^e MDC presented only if it exceeds SSSL-n.

^f Incremental lifetime cancer risk for resident exposed to chemical in soil.

^g Hazard index for noncancer effects for resident exposed to chemical in soil.

^h SSSL based on chromium VI.

Table 2

Preliminary Risk Assessment for Exposure to Total Soil (Surface and Subsurface Soil Combined)
Ranges West of Iron Mountain Road
Fort McClellan, Calhoun County, Alabama

| Chemical | MDC | Site-Related Chemical? ^a | Residential Soil SSSL-c ^b | Residential Soil SSSL-n ^c | Residential Cancer COPC? ^d | Residential Noncancer COPC? ^e | Residential ILCR ^f | Residential HI ^g |
|------------------------------|----------|-------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|--|-------------------------------|-----------------------------|
| Metals | | | | | | | | |
| Aluminum | 4.44E+04 | No(3) | NA | 7.80E+03 | | | | |
| Antimony | 8.98E+00 | No(2) | NA | 3.11E+00 | | | | |
| Arsenic | 3.06E+01 | No(2) | 4.26E-01 | 2.34E+00 | | | | |
| Barium | 3.55E+02 | No(2) | NA | 5.47E+02 | | | | |
| Beryllium | 6.71E+00 | No(3) | NA | 9.60E+00 | | | | |
| Cadmium | 4.37E+00 | 4.37E+00 | NA | 6.25E+00 | | | | |
| Calcium | 9.12E+03 | No(E) | NA | NA | | | | |
| Chromium ^h | 1.02E+02 | No(2) | NA | 2.32E+01 | | | | |
| Cobalt | 6.57E+01 | No(2) | NA | 4.68E+02 | | | | |
| Copper | 6.14E+01 | No(2) | NA | 3.13E+02 | | | | |
| Iron | 9.42E+04 | No(2) | NA | 2.34E+03 | | | | |
| Lead | 3.18E+03 | No(2) | NA | 4.00E+02 | | | | |
| Magnesium | 5.29E+03 | No(E) | NA | NA | | | | |
| Manganese | 7.31E+03 | No(2) | NA | 3.63E+02 | | | | |
| Mercury | 2.70E-01 | No(3) | NA | 2.33E+00 | | | | |
| Nickel | 8.64E+01 | No(2) | NA | 1.54E+02 | | | | |
| Potassium | 2.79E+03 | No(E) | NA | NA | | | | |
| Selenium | 2.81E+00 | 2.81E+00 | NA | 3.91E+01 | | | | |
| Sodium | 9.41E+01 | No(E) | NA | NA | | | | |
| Thallium | 3.81E+00 | No(3) | NA | 5.08E-01 | | | | |
| Vanadium | 1.21E+02 | No(1) | NA | 5.31E+01 | | | | |
| Zinc | 3.35E+02 | No(3) | NA | 2.34E+03 | | | | |
| Semivolatile Organics | | | | | | | | |
| 2,4-Dinitrotoluene | 2.20E-01 | 2.20E-01 | 9.27E-01 | 1.55E+01 | | | | |
| Pentachlorophenol | 2.50E-01 | 2.50E-01 | 5.25E+00 | 2.33E+02 | | | | |
| Pyrene | 3.70E-01 | 3.70E-01 | NA | 2.33E+02 | | | | |
| Volatile Organics | | | | | | | | |
| 2-Butanone | 1.20E-02 | 1.20E-02 | NA | 4.66E+03 | | | | |
| Acetone | 3.90E-01 | 3.90E-01 | NA | 7.76E+02 | | | | |
| Methylene chloride | 1.20E-03 | 1.20E-03 | 8.41E+01 | 4.66E+02 | | | | |
| p-Cymene | 2.20E-03 | 2.20E-03 | NA | 1.55E+03 | | | | |
| Toluene | 1.50E-03 | 1.50E-03 | NA | 1.55E+03 | | | | |
| Total ILCR, HI | | | | | | | -- | -- |

Table 2

**Preliminary Risk Assessment for Exposure to Total Soil (Surface and Subsurface Soil Combined)
Ranges West of Iron Mountain Road
Fort McClellan, Calhoun County, Alabama**

All concentrations expressed as mg/kg.

MDC = Maximum Detected Concentration; COPC = Chemical of Potential Concern; ILCR = Incremental Lifetime Cancer Risk; HI = Hazard Index.

-- = Not Calculated

NA = Not Available

^a MDC presented only for site-related chemicals.

No(E) = Deselected as a site-related chemical as a nutritionally required element.

No(1) = Deselected as a site-related chemical at Tier 1.

No(2) = Deselected as a site-related chemical at Tier 2.

No(3) = Deselected as a site-related chemical at Tier 3.

^b Site-specific screening level based on cancer risk for residential exposure to soil.

^c Site-specific screening level based on noncancer hazard for residential exposure to soil.

^d MDC presented only if it exceeds SSSL-c.

^e MDC presented only if it exceeds SSSL-n.

^f Incremental lifetime cancer risk for resident exposed to chemical in soil.

^g Hazard index for noncancer effects for resident exposed to chemical in soil.

^h SSSL based on chromium VI.

Table 3

**Preliminary Risk Assessment for Exposure to Groundwater
Ranges West of Iron Mountain Road
Fort McClellan, Calhoun County, Alabama**

| Chemical | MDC | Site-Related Chemical? ^a | Residential Groundwater SSSL-c ^b | Residential Groundwater SSSL-n ^c | Residential Cancer COPC? ^d | Residential Noncancer COPC? ^e | Residential ILCR ^f | Residential HI ^g | MCL ^h |
|---|----------|-------------------------------------|---|---|---------------------------------------|--|-------------------------------|-----------------------------|------------------|
| Metals | | | | | | | | | |
| Aluminum | 3.71E+00 | No(2) | NA | 1.56E+00 | | | | | |
| Arsenic | 3.60E-03 | No(1) | 4.46E-05 | 4.69E-04 | | | | | |
| Barium | 1.78E-01 | No(2) | NA | 1.10E-01 | | | | | |
| Beryllium | 5.12E-03 | 5.12E-03 | NA | 3.13E-03 | | 5.12E-03 | | 1.64E-01 | |
| Calcium | 8.58E+01 | No(E) | NA | NA | | | | | |
| Chromium ⁱ | 1.92E-02 | No(3) | NA | 4.69E-03 | | | | | |
| Cobalt | 3.70E-02 | No(2) | NA | 9.39E-02 | | | | | |
| Copper | 1.70E-02 | No(1) | NA | 6.26E-02 | | | | | |
| Iron | 9.36E+00 | No(2) | NA | 4.69E-01 | | | | | |
| Lead | 9.64E-03 | No(2) | NA | 1.50E-02 | | | | | |
| Magnesium | 1.64E+01 | No(E) | NA | NA | | | | | |
| Manganese | 1.98E+00 | No(2) | NA | 7.35E-02 | | | | | |
| Mercury | 1.36E-04 | No(2) | NA | 4.69E-04 | | | | | |
| Nickel | 4.08E-02 | No(3) | NA | 3.13E-02 | | | | | |
| Potassium | 9.72E+00 | No(E) | NA | NA | | | | | |
| Selenium | 2.44E-03 | No(2) | NA | 7.82E-03 | | | | | |
| Silver | 7.64E-03 | No(2) | NA | 7.82E-03 | | | | | |
| Sodium | 9.90E+00 | No(E) | NA | NA | | | | | |
| Thallium | 4.80E-03 | No(2) | NA | 1.02E-04 | | | | | |
| Vanadium | 2.58E-02 | No(2) | NA | 1.10E-02 | | | | | |
| Zinc | 1.98E-01 | No(1) | NA | 4.69E-01 | | | | | |
| Nitroaromatic & Nitramine Explosives | | | | | | | | | |
| 1,3,5-Trinitrobenzene | 5.10E-04 | 5.10E-04 | NA | 4.69E-02 | | | | | |
| 2,4,6-Trinitrotoluene | 9.20E-05 | 9.20E-05 | 2.23E-03 | 7.80E-04 | | | | | |
| 2,4-Dinitrotoluene | 7.20E-05 | 7.20E-05 | 9.79E-05 | 3.11E-03 | | | | | |
| 2,6-Dinitrotoluene | 1.70E-04 | 1.70E-04 | 9.81E-05 | 1.56E-03 | 1.70E-04 | | 1.73E-06 | | |
| 2-Nitrotoluene | 5.70E-03 | 5.70E-03 | NA | 1.53E-02 | | | | | |
| 3-Nitrotoluene | 1.50E-03 | 1.50E-03 | NA | 1.53E-02 | | | | | |
| p-Nitrotoluene | 1.40E-03 | 1.40E-03 | NA | 1.53E-02 | | | | | |
| Tetryl | 2.10E-04 | 2.10E-04 | NA | 1.56E-02 | | | | | |
| Perchlorate | | | | | | | | | |
| Perchlorate | 2.55E-03 | 2.55E-03 | NA | 1.41E-03 | | 2.55E-03 | | 1.81E-01 | |
| Volatile Organics | | | | | | | | | |
| Acetone | 8.20E-01 | 8.20E-01 | NA | 1.56E-01 | | 8.20E-01 | | 5.25E-01 | |
| Benzene | 8.30E-04 | 8.30E-04 | 9.26E-04 | 6.07E-03 | | | | | 5.00E-03 |

Table 3

**Preliminary Risk Assessment for Exposure to Groundwater
Ranges West of Iron Mountain Road
Fort McClellan, Calhoun County, Alabama**

| Chemical | MDC | Site-Related Chemical? ^a | Residential Groundwater SSSL-c ^b | Residential Groundwater SSSL-n ^c | Residential Cancer COPC? ^d | Residential Noncancer COPC? ^e | Residential ILCR ^f | Residential HI ^g | MCL ^h |
|-----------------------|----------|-------------------------------------|---|---|---------------------------------------|--|-------------------------------|-----------------------------|-----------------------|
| Chloroform | 4.20E-03 | 4.20E-03 | NA | 1.54E-02 | | | | | 8.00E-02 ^j |
| Chloromethane | 1.40E-03 | 1.40E-03 | 3.93E-03 | 6.22E-03 | | | | | |
| Methylene chloride | 3.80E-03 | 3.80E-03 | 7.85E-03 | 9.32E-02 | | | | | 5.00E-03 |
| p-Cymene | 2.30E-03 | 2.30E-03 | NA | 2.26E-01 | | | | | |
| Toluene | 1.60E-03 | 1.60E-03 | NA | 2.59E-01 | | | | | 1.00E+00 |
| Trichloroethene | 1.20E-03 | 1.20E-03 | 4.51E-03 | 9.15E-03 | | | | | 5.00E-03 |
| Total ILCR, HI | | | | | | | 1.73E-06 | 8.69E-01 | |

All concentrations expressed as mg/L.

MDC = Maximum Detected Concentration; COPC = Chemical of Potential Concern; ILCR = Incremental Lifetime Cancer Risk; HI = Hazard Index; MCL = maximum contaminant level.

NA = Not Available

^a MDC presented only for site-related chemicals.

No(E) = Deselected as a site-related chemical as a nutritionally required element.

No(1) = Deselected as a site-related chemical at Tier 1.

No(2) = Deselected as a site-related chemical at Tier 2.

No(3) = Deselected as a site-related chemical at Tier 3.

^b Site-specific screening level based on cancer risk for residential exposure to groundwater.

^c Site-specific screening level based on noncancer hazard for residential exposure to groundwater.

^d MDC presented only if it exceeds SSSL-c.

^e MDC presented only if it exceeds SSSL-n.

^f Incremental lifetime cancer risk for resident exposed to chemical in groundwater.

^g Hazard index for noncancer effects for resident exposed to chemical in groundwater.

^h EPA, 2002, 2002 Edition of the Drinking Water Standards and Health Advisories, Office of Water, Washington, DC, EPA 822-R-02-038, Summer.

ⁱ Based on SSSL for chromium VI.

^j MCL for total trihalomethanes.

Table 4

**Preliminary Risk Assessment for Exposure to Surface Water
Ranges West of Iron Mountain Road
Fort McClellan, Calhoun County, Alabama**

| Chemical | MDC | Site-Related Chemical? ^a | Recreational Site User Surface Water SSSL-c ^b | Recreational Site User Surface Water SSSL-n ^c | Recreational Site User Cancer COPC? ^d | Recreational Site User Noncancer COPC? ^e | Recreational Site User ILCR ^f | Recreational Site User HI ^g |
|-----------------------|----------|-------------------------------------|--|--|--|---|--|--|
| Metals | | | | | | | | |
| Aluminum | 9.71E+00 | No(2) | NA | 1.53E+01 | | | | |
| Arsenic | 5.45E-03 | No(3) | 7.31E-04 | 4.70E-03 | | | | |
| Barium | 6.24E-02 | No(1) | NA | 1.10E+00 | | | | |
| Calcium | 9.21E+00 | No(E) | NA | NA | | | | |
| Chromium ^h | 5.80E-03 | No(1) | NA | 4.08E-02 | | | | |
| Copper | 4.42E-03 | No(1) | NA | 6.23E-01 | | | | |
| Iron | 1.16E+01 | No(1) | NA | 4.70E+00 | | | | |
| Lead | 1.80E-02 | No(2) | NA | 1.50E-02 | | | | |
| Magnesium | 5.29E+00 | No(E) | NA | NA | | | | |
| Manganese | 2.12E-01 | No(1) | NA | 6.40E-01 | | | | |
| Nickel | 1.15E-02 | No(1) | NA | 3.10E-01 | | | | |
| Selenium | 3.27E-03 | No(2) | NA | 7.82E-02 | | | | |
| Sodium | 1.73E+00 | No(E) | NA | NA | | | | |
| Vanadium | 1.65E-02 | No(2) | NA | 7.90E-02 | | | | |
| Zinc | 1.22E-02 | No(1) | NA | 4.65E+00 | | | | |
| Perchlorate | | | | | | | | |
| Perchlorate | 2.66E-03 | 2.66E-03 | NA | 1.42E-02 | | | | |
| Total ILCR, HI | | | | | | | -- | -- |

All concentrations expressed as mg/L.

MDC = Maximum Detected Concentration; COPC = Chemical of Potential Concern; ILCR = Incremental Lifetime Cancer Risk; HI = Hazard Index.

-- = Not Calculated

NA = Not Available

^a MDC presented only for site-related chemicals.

No(E) = Deselected as a site-related chemical as a nutritionally required element.

No(1) = Deselected as a site-related chemical at Tier 1.

No(2) = Deselected as a site-related chemical at Tier 2.

No(3) = Deselected as a site-related chemical at Tier 3.

^b Site-specific screening level based on cancer risk for recreational exposure to surface water.

^c Site-specific screening level based on noncancer hazard for recreational exposure to surface water.

^d MDC presented only if it exceeds SSSL-c.

^e MDC presented only if it exceeds SSSL-n.

^f Incremental lifetime cancer risk for recreational site user exposed to chemical in surface water.

^g Hazard index for noncancer effects for recreational site user exposed to chemical in surface water.

^h SSSL based on chromium VI.

Table 5

**Preliminary Risk Assessment for Exposure to Sediment
Ranges West of Iron Mountain Road
Fort McClellan, Calhoun County, Alabama**

| Chemical | MDC | Site-Related Chemical? ^a | Recreational Site User Sediment SSSL-c ^b | Recreational Site User Sediment SSSL-n ^c | Recreational Site User Cancer COPC? ^d | Recreational Site User Noncancer COPC? ^e | Recreational Site User ILCR ^f | Recreational Site User HI ^g |
|-----------------------------|----------|-------------------------------------|---|---|--|---|--|--|
| Metals | | | | | | | | |
| Aluminum | 1.11E+04 | No(3) | NA | 1.15E+06 | | | | |
| Arsenic | 1.06E+01 | No(1) | 5.58E+01 | 3.59E+02 | | | | |
| Barium | 1.12E+02 | No(2) | NA | 8.36E+04 | | | | |
| Beryllium | 1.18E+00 | No(2) | NA | 1.50E+02 | | | | |
| Cadmium | 8.82E-01 | No(3) | NA | 1.71E+02 | | | | |
| Calcium | 1.57E+03 | No(E) | NA | NA | | | | |
| Chromium ^h | 5.63E+01 | No(2) | NA | 2.79E+03 | | | | |
| Cobalt | 1.47E+01 | No(2) | NA | 6.72E+04 | | | | |
| Copper | 4.48E+01 | No(2) | NA | 4.74E+04 | | | | |
| Iron | 3.92E+04 | No(2) | NA | 3.59E+05 | | | | |
| Lead | 6.14E+01 | No(2) | NA | 4.00E+02 | | | | |
| Magnesium | 1.80E+03 | No(E) | NA | NA | | | | |
| Manganese | 1.27E+03 | No(2) | NA | 4.38E+04 | | | | |
| Mercury | 1.81E-01 | No(3) | NA | 2.99E+02 | | | | |
| Nickel | 2.41E+01 | No(2) | NA | 1.76E+04 | | | | |
| Potassium | 6.75E+02 | No(E) | NA | NA | | | | |
| Sodium | 3.99E+01 | No(E) | NA | NA | | | | |
| Vanadium | 6.30E+01 | No(2) | NA | 4.83E+03 | | | | |
| Zinc | 1.26E+02 | No(2) | NA | 3.44E+05 | | | | |
| Total Organic Carbon | | | | | | | | |
| Total Organic Carbon | 2.68E+02 | 2.68E+02 | NA | NA | | | | |
| Total ILCR, HI | | | | | | | -- | -- |

All concentrations expressed as mg/kg.

MDC = Maximum Detected Concentration; COPC = Chemical of Potential Concern; ILCR = Incremental Lifetime Cancer Risk; HI = Hazard Index.

-- = Not Calculated

NA = Not Available

^a MDC presented only for site-related chemicals.

No(E) = Deselected as a site-related chemical as a nutritionally required element.

No(1) = Deselected as a site-related chemical at Tier 1.

No(2) = Deselected as a site-related chemical at Tier 2.

No(3) = Deselected as a site-related chemical at Tier 3.

^b Site-specific screening level based on cancer risk for recreational exposure to sediment.

^c Site-specific screening level based on noncancer hazard for recreational exposure to sediment.

^d MDC presented only if it exceeds SSSL-c.

^e MDC presented only if it exceeds SSSL-n.

^f Incremental lifetime cancer risk for recreational site user exposed to chemical in sediment.

^g Hazard index for noncancer effects for recreational site user exposed to chemical in sediment.

^h SSSL based on chromium VI.